DECLARATION

I, Ryuichi YAMADA, a Japanese Patent Attorney registered No. 7898 having my Business Office at Hasegawa Bldg., 4F, 7-7 Toranomon 3-chome, Minato-ku, Tokyo, Japan, solemnly and sincerely declare:

That I have a thorough knowledge of Japanese and English languages; and

That the attached pages contain a correct translation into English of the specification of the following Japanese Application:

APPLICATION NUMBER	DATE OF APPLICATION
284601/2001(Pat.)	19/SEP/2001

Applicant(s)

CANON KABUSHIKI KAISHA

Signed this 9th day of May, 2003.

Ryuichi YAMADA

PATENT OFFICE

JAPANESE GOVERNMENT

This is to certify that the annexed is a true copy of the following application as filed with this Office.

APPLICATION NUMBER	DATE OF APPLICATION
284601/2001(Pat.)	19/SEP/2001

Applicant(s)

19/OCT/2001

Director-General,
Patent Office : KOZO OIKAWA (Seal)

Certificate No. 3092042/2001

<DOCUMENT> PATENT APPLICATION
<FILE NO.> 4557003
<FILING DATE> 19/SEP/2001
<DIRECTED TO> The Director General of the Patent Office
<INTERNATIONAL CLASSIFICATION> H05B 33/00
<TITLE OF THE INVENTION> LUMINESCENCE DEVICE AND METAL COORDINATION COMPOUND FOR THE LUMINESCENCE DEVICE

<NUMBER OF CLAIMS> 11
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<CLAIM FOR PRIORITY>
<APPLICATION NO.> 292491/2000(Pat.)
<FILING DATE> 26/SEP/2000

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<ARTICLE> Specification 1
<ARTICLE> Drawing(s) 1
<ARTICLE> Abstract 1
<GENERAL POWER NO.> 0101029

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[Document]

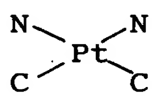
Specification

[Title of the Invention]

Luminescence Device and Metal Coordination Compound for the Luminescence Device

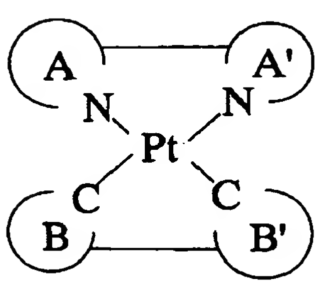
[Claims]

1. A luminescence device, comprising: an organic compound layer comprising a metal coordination compound having a partial structure represented by the following formula (1):



(1).

2. A device according to Claim 1, wherein the metal coordination compound is represented by any one of the following formulas (1-1) to (1-6):



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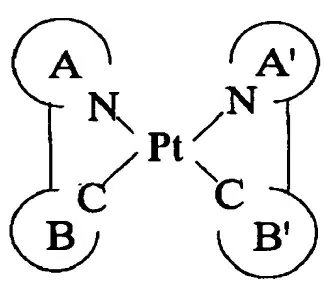

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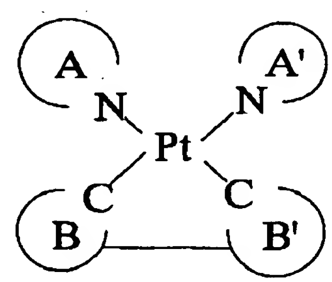

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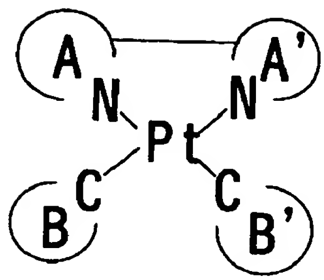

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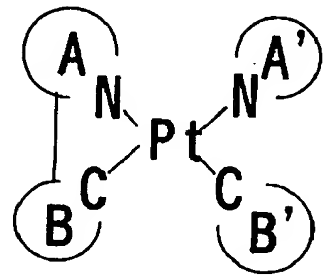

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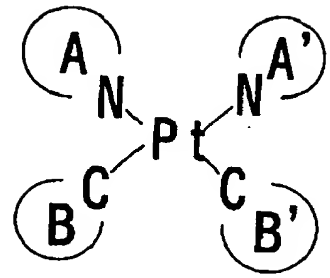


(1-6)

{with the proviso that: N and C are nitrogen and carbon atoms, respectively, connected to Pt; A and A' respectively denote a cyclic group, containing a nitrogen atom, which may be unsubstituted or capable of having a substituent, and B and B' respectively denote a cyclic group containing a carbon atom, which may be unsubstituted or capable of having a substituent, [said substituents respectively denote a halogen atom; nitro group; a trialkylsilyl group (of which alkyl group is a linear or branched alkyl group having 1 - 8 carbon atoms); and a linear or branched alkyl group having 1 - 20 carbon atoms (wherein one or at least two non-neighboring methylene groups may be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- or -C≡C- and a hydrogen atom in the alkyl group may be replaced with a fluorine atom)]}.

3. A device according to Claim 2, wherein the metal coordination compound is represented by the

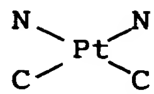
formula (1-1) or the formula (1-2).

4. A device according to Claim 2 or 3, wherein at least one of the cyclic groups A and A' containing a nitrogen atom connected to a platinum atom in the formulas (1-1) to (1-6) is a substituted or unsubstituted cyclic group which is any one of pyridine, pyrimidine, pyrazoline, pyrrole, pyrazole, quinoline, isoquinoline, and quinoxaline.

5. A device according to any one of Claims 2 - 4, wherein at least one of the cyclic groups B and B' containing carbon atom connected to a platinum atom in the formulas (1-1) to (1-6) is a substituted or unsubstituted cyclic group which is any one of phenyl, naphthyl, thienyl, benzothienyl, and quinolyl.

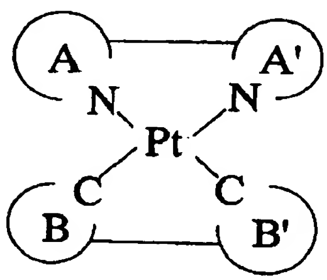
6. A device according to any one of Claims 1 - 5, further comprising type electrodes oppositely disposed to sandwich the organic compound layer containing said metal coordination compound, wherein a voltage is applied between the electrodes to produce luminescence.

7. A metal coordination compound for a luminescence device, having a partial structure represented by the following formula (1):



(1),

8. A compound according to Claim 7, which is represented by any one of the following formulas (1-1) to (1-6):



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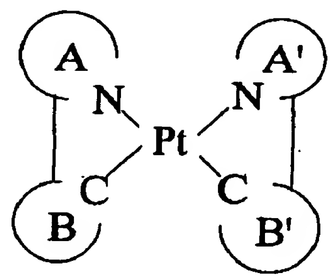

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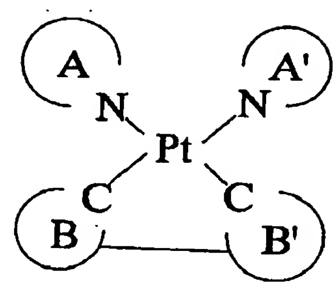

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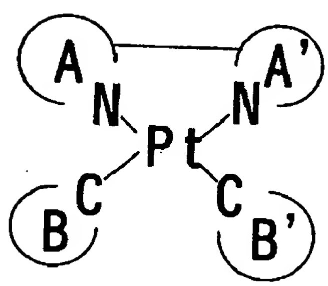

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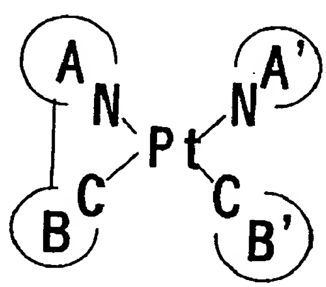

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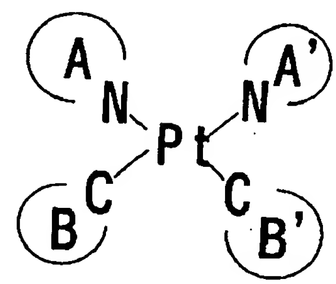


(1-6)

{with the proviso that: N and C are nitrogen and carbon atoms, respectively, connected to Pt; A and A' respectively denote a cyclic group, containing a nitrogen atom, which may be unsubstituted or capable of having a substituent, and B and B' respectively denote a cyclic group containing a

carbon atom, which may be unsubstituted or capable of having a substituent, [said substituents respectively denote a halogen atom; nitro group; a trialkylsilyl group (of which alkyl group is a linear or branched alkyl group having 1 - 8 carbon atoms); and a linear or branched alkyl group having 1 - 20 carbon atoms (wherein one or at least two non-neighboring methylene groups may be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- or -C≡C- and a hydrogen atom in the alkyl group may be replaced with a fluorine atom)]}.

9. A compound according to Claim 8, wherein the metal coordination compound is represented by the formula (1-1) or the formula (1-2).

10. A compound according to Claim 8 or 9, wherein at least one of the cyclic groups A and A' containing a nitrogen atom connected to a platinum atom in the formulas (1-1) to (1-6) is a substituted or unsubstituted cyclic group which is any one of pyridine, pyrimidine, pyrazoline, pyrrole, pyrazole, quinoline, isoquinoline, and quinoxaline.

11. A compound according to any one of Claims 8 - 10, wherein at least one of the cyclic groups B and B' containing carbon atom connected to a platinum atom in the formulas (1-1) to (1-6) is a substituted or

unsubstituted cyclic group which is any one of phenyl, naphthyl, thienyl, benzothienyl, and quinolyl.

[Detailed Description of the Invention]

[0001]

[Technical Field to which the Invention Pertains]

The present invention relates to a luminescence device and a metal coordination compound for the luminescence device. More specifically, the present invention relates to a luminescence device employing an organic metal coordination compound having platinum center metal as a luminescence material so as to allow stable and high luminescence efficiency.

[0002]

[Prior Art]

An organic EL (electroluminescence) device has been extensively studied as a luminescence device with a high responsiveness and high efficiency. The organic EL device generally has a basic structure as shown in Figure 1(a), (b) (e.g., as described in "Macromol. Symp.", 125, pp. 1 - 48 (1997)).

[0003]

As shown in Figure 1, the EL device is generally constituted by disposing, on a transparent substrate 15, a plurality of organic film layers between a transparent electrode 14 and a metal

electrode 11.

In Figure 1(a), the organic layers includes a luminescence layer 12 and a hole transport layer 13.

As transparent electrode 14, a film of ITO (indium tin oxide) having a larger work function is used so as to ensure a good hole injection performance from the transparent electrode 14 into the hole transport layer 13. As the metal electrode 11, a layer of metal material such as aluminum, magnesium, alloys thereof, etc., having a smaller work function is used so as to ensure a good electron injection performance into the organic layer(s).

These electrodes may be formed in a thickness of 50 - 200 nm.

[0005]

The luminescence layer 12 may be formed of, e.g., aluminum quinolinol complex (representative example thereof may include Alq3 described hereinafter) having an electron transporting characteristic and a luminescent characteristic. The hole transport layer 13 may be formed of, e.g., triphenyldiamine derivative (representative example thereof may include α-NPD described hereinafter) having an electron donating characteristic.

[0006]

The above-described EL device exhibits an electrical rectification characteristic, so that when

an electric field is applied between the metal electrode 11 as a cathode and the transparent electrode 14 as an anode, electrons are injected from the metal electrode 11 into the luminescence layer 12 and holes are injected from the transparent electrodes 15.

[0007]

The thus-injected holes and electrons are recombined within the luminescence layer 12 to produce excitons, thus producing luminescence. At that time, the hole transport layer 13 functions as an electron-blocking layer to increase a recombination efficiency at the boundary between the luminescence layer 12 and the hole transport layer 13, thus enhancing a luminescence efficiency.

[0008]

Further, in Figure 1(b), an electron transport layer 16 is disposed between the metal electrode 11 and the luminescence layer 12 shown in Figure 1(a), whereby an effective carrier blocking performance can be ensured by separating functions of luminescence, electron transport and hole transport, thus allowing efficient luminescence. The electron transport layer 16 may be formed of, e.g., oxadiazole derivatives.

[0009]

Heretofore, in ordinary organic EL devices,

fluorescence produced during a transition of luminescent center molecule from a singlet excited state to a ground state has been used as luminescence. On the other hand, not the above fluorescence (luminescence) via singlet exciton, phosphorescence (luminescence) via triplet exciton has been studied for use in organic EL device as described in, e.g., Document 1: "Improved energy transfer in electrophosphorescent device" (D.F. O'Brien et al., Applied Physics Letters, Vol. 74, No. 3, pp. 442 - (1999)) and Document 2: "Very high-efficiency green organic light-emitting devices based on electrophosphorescence" (M.A. Baldo et al., Applied Physics Letters, Vol. 75, No. 1, pp. 4 - 1999)).

[0010]

In these documents, a four layer-structure of organic layers as shown in Figure 1(c) is principally used. The structure includes a hole transfer layer 13, a luminescence layer 12, an exciton diffusion-prevention layer 17, and an electron transport layer 16 successively formed in this order from the anode side. The materials used therefor are carrier transporting materials and phosphorescent materials shown below. Abbreviations for the respective materials are follows.

Alq3: aluminum-quinolinol complex,

α-NPD: N4,N4'-di-naphthalene-1-yl-N4,N4'-

diphenyl-biphenyl-4,4'-diamine,

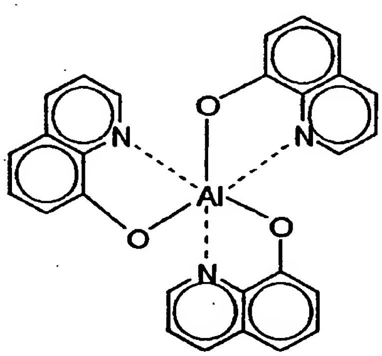
CBP: 4,4'-N,N'-dicarbazole-biphenyl,

BCP: 2,9-dimethyl-4,7-diphenyl-1,10-phenanthroline,

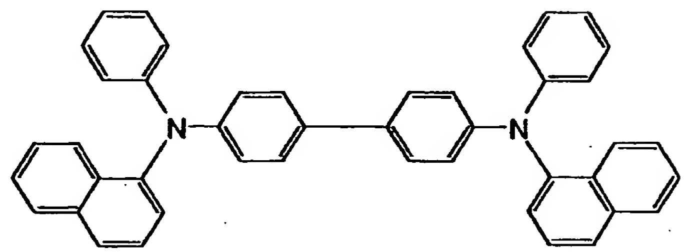
PtEOP: platinum-octaethyl porphine complex, and

Ir(ppy)$_3$: iridium-phenylpyridine complex.

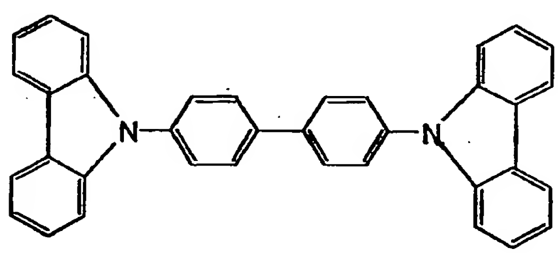
[0011]



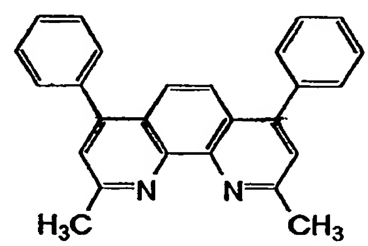
Alq3



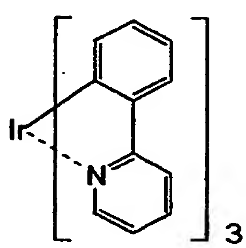
α -NPD



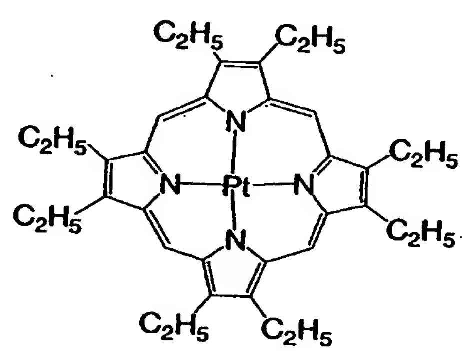
CBP



BCP



Ir(ppy)$_3$



pt-OEP

[0012]

In the above Documents 1 and 2, higher efficiencies have been achieved by using a hole transport layer 13 of α-NPD, an electron transport layer 16 of Alq3, an exciton diffusion-prevention layer 17 of BPC, and a luminescence layer 12 of a mixture of CPB as a host material with $Ir(ppy)_3$ or PtOEP doped into CBP at a concentration of ca. 6 wt. %.

[0013]

The reason why the phosphorescence (luminescence) material has particularly attracted notice is that the phosphorescence material is expected to provide a higher luminescence efficiency in principle. The reason is as follows. Excitons produced by recombination of carriers comprise singlet excitons and triplet excitons presented in a ratio of 1:3. Fluorescence produced during the transition from the singlet excited state to the ground state is utilized as luminescence in the conventional organic EL devices. However, a resultant luminescence efficiency is 25 % (being upper limit) based on all the produced excitons in principle.

However, if phosphorescence produced during transition from the triplet excited state is employed, a resultant luminescence efficiency is expected to be at least three times (that of the case of

fluorescence) in principle. In addition thereto, if intersystem crossing from the singlet excited state which is a higher energy level to the triplet excited state is taken into consideration, the luminescence efficiency of phosphorescence can be expected to be 100 %, which is four times that of fluorescence, in principle.

[0014]

The use of phosphorescence based on transition from the triplet excited state has also been proposed in, e.g., Japanese Laid-Open Patent Application (JP-A) 11-329739 (organic EL device and production process thereof), JP-A 11-256148 (luminescent material and organic EL device using the same) and JP-A 8-319482 (organic electroluminescent device).

[0015]

[Problems to be Solved by the Invention]

The above-mentioned organic EL devices utilizing phosphorescence have accompanied with a problem of luminescent deterioration particularly in an energized state. The reason for luminescent deterioration has not been clarified as yet but may be attributable to such a phenomenon that the life of triplet exciton is generally longer than that of singlet exciton by at least three digits, so that molecule is placed in a higher-energy state for a long

period to cause reaction with ambient substance, formation of exciplex or excimer, change in minute molecular structure, structural change of ambient substance, etc.

[0016]

Anyway, the phosphorescence luminescence device is expected to provide a higher luminescence efficiency as described above, while the device is accompanied with the problem of luminescent deterioration in energized state.

[0017]

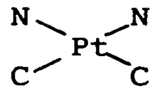
An object of the present invention is to provide a luminescence device capable of producing a high-efficiency luminescence at a high brightness (or luminance) for a long period while minimizing the deterioration in luminescence in energized state, and to provide a metal coordination compound for the luminescence device.

[0018]

[Means for Solving the Problems]

More specifically, there is provided a luminescence device according to the present invention, comprising: an organic compound layer comprising a metal coordination compound having a partial structure represented by the following formula (1):

[0019]

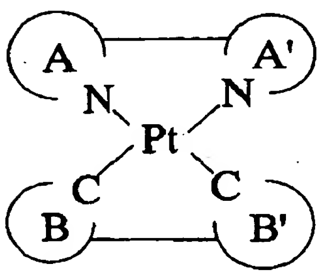


(1).

[0020]

The luminescence device according to the present invention uses the metal coordination compound which may preferably be represented by any one of the following formulas (1-1) to (1-6), more preferably (1-1) or (1-2):

[0021]



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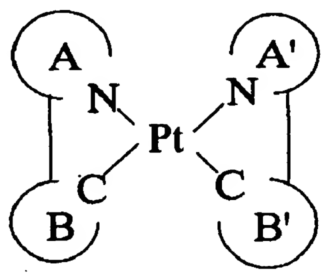

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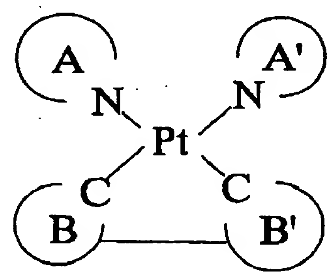

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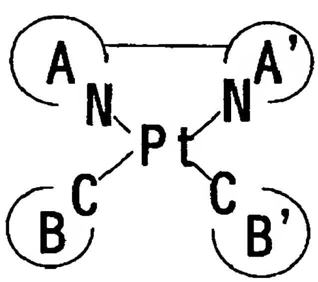

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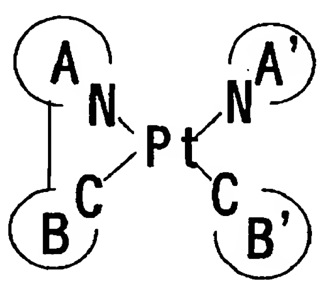

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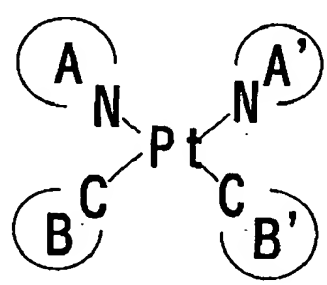


(1-6)

[0022]

{with the proviso that: N and C are nitrogen and carbon atoms, respectively, connected to Pt; A and A' respectively denote a cyclic group, containing a nitrogen atom, which may be unsubstituted or capable of having a substituent, and B and B' respectively denote a cyclic group containing a carbon atom, which may be unsubstituted or capable of having a substituent, [said substituents respectively denote a halogen atom; nitro group; a trialkylsilyl group (of which alkyl group is a linear or branched alkyl group having 1 - 8 carbon atoms); and a linear or branched alkyl group having 1 - 20 carbon atoms (wherein one or at least two non-neighboring methylene groups may be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- or -C≡C- and a hydrogen atom in the alkyl group may be replaced with a fluorine atom)]}.

[0023]

Further at least one of the cyclic groups A and A' containing a nitrogen atom connected to a platinum atom in the formulas (1-1) to (1-6) may preferably be a substituted or unsubstituted cyclic group which is any one of pyridine, pyrimidine, pyrazoline, pyrrole, pyrazole, quinoline, isoquinoline, and quinoxaline; and at least one of the cyclic groups B and B' containing carbon atom connected to a platinum atom in the formulas (1-1) to

(1-6) may preferably be a substituted or unsubstituted cyclic group which is any one of phenyl, naphthyl, thienyl, benzothienyl, and quinolyl.

[0024]

Further, the luminescence device may preferably be an electroluminescence device further comprising type electrodes oppositely disposed to sandwich the organic compound layer containing said metal coordination compound, wherein a voltage is applied between the pair of electrodes to produce luminescence.

[0025]

The present invention further provides a metal coordination compound for a luminescence device, having a partial structure represented by the above-mentioned formula (1).

[0026]

[Embodiments for Practicing the Invention]

In the case where a luminescence layer is formed of a carrier transporting host material and a phosphorescent guest material, a process of emission of light from the triplet exciton may generally involve the following steps:

(1) transport of electron and hole within a luminescence layer,

(2) formation of exciton of the host material,

(3) transmission of excited energy between host

material molecules,

(4) transmission of excited energy from the host material molecule to the guest material molecule,

(5) formation of triplet exciton of the guest material, and

(6) phosphorescence produced during transition from the triplet excited state to the ground state of the guest material.

[0027]

In the respective steps, desired energy transmission and luminescence may be caused based on various deactivation and competition.

[0028]

In order to improve a luminescence efficiency of the EL device, a luminescence center material per se is required to provide a higher yield of luminescence quantum. However, an efficient energy transfer between host material molecules and/or between host material molecule and guest material molecule is also an important factor. Further, the case of the luminescent deterioration in energized state has not been clarified as yet but may presumably relate to the luminescent center material per se or an environmental change thereof by its ambient molecular structure.

[0029]

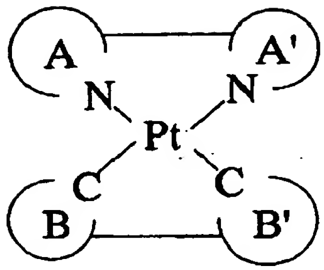
For this reason, the present inventors have

investigated an effect of use of the platinum complex having a partial structure of the above-mentioned formula (1) as the luminescent center material and as a result, have found that the metal platinum complex allows a high-efficiency luminescence and maintains a high brightness (luminance) for a long period less decreased luminescent deterioration in energized state). Although values therefor are different depending on required performances, for example, a luminescence efficiency of 1 cd/W or above with respect to an input current value may be referred to as a high efficiency, and a luminance half-life time of 500 hours or above in the case of luminescence at an initial luminance of 100 cd/m^2 may be referred to as a longer high-luminance period or less deterioration in energized state.

[0030]

The metal coordination compound having a partial structure of formula (1) may preferably be represented by any one of the following formulas (1-1) to (1-6) more preferably (1-1) or (1-2) which provide a high-efficiency luminescence, maintain a high brightness for a long time, and provide less (luminescence) deterioration in energized state.

[0031]



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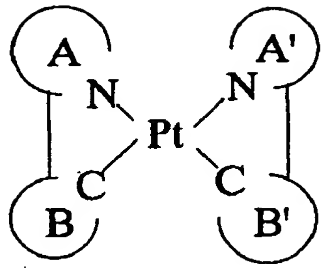

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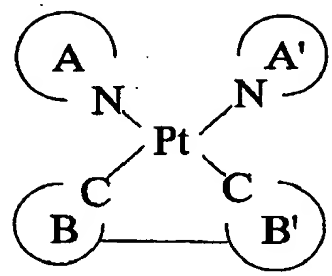

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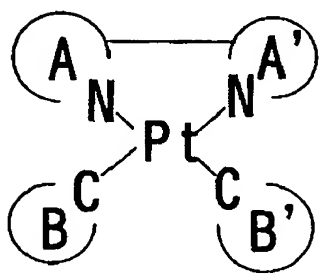

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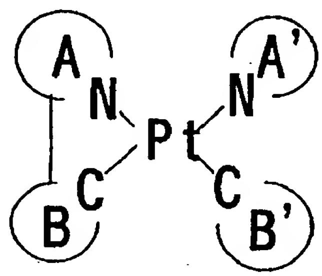

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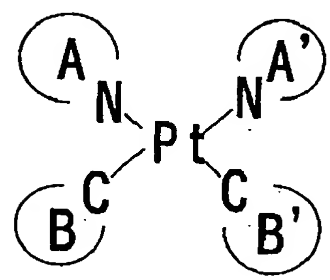


(1-6)

[0032]

{with the proviso that: N and C are nitrogen and carbon atoms, respectively, connected to Pt; A and A' respectively denote a cyclic group, containing a nitrogen atom, which may be unsubstituted or capable of having a substituent, and B and B' respectively denote a cyclic group containing a carbon atom, which may be unsubstituted or capable of having a substituent, [said substituents respectively denote a halogen atom; nitro group; a trialkylsilyl group (of which alkyl group is a linear or branched

alkyl group having 1 - 8 carbon atoms); and a linear or branched alkyl group having 1 - 20 carbon atoms (wherein one or at least two non-neighboring methylene groups may be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- or -C≡C- and a hydrogen atom in the alkyl group may be replaced with a fluorine atom)]}.

[0033]

Further at least one of the cyclic groups A and A' containing a nitrogen atom connected to a platinum atom in the formulas (1-1) to (1-6) may preferably be a substituted or unsubstituted cyclic group which is any one of pyridine, pyrimidine, pyrazoline, pyrrole, pyrazole, quinoline, isoquinoline, and quinoxaline; and at least one of the cyclic groups B and B' containing carbon atom connected to a platinum atom in the formulas (1-1) to (1-6) may preferably be a substituted or unsubstituted cyclic group which is any one of phenyl, naphthyl, thienyl, benzothienyl, and quinolyl.

[0034]

The platinum complex produces phosphorescence (luminescence) and is assumed to have a lowest excited state comprising a triplet excited state liable to cause metal-to-ligand charge transfer ($MLCT^*$) state. The phosphorescent emission of light (phosphorescence) is produced during the transition from the $MLCT^*$ state to the ground state.

[0035]

The luminescent material according to the present invention has been found to provide a higher phosphorescence yield of 0.05 - 0.9 and a shorter phosphorescence life of 1 - 30 μsec.

The shorter phosphorescence life becomes a condition for providing a resultant EL device with a higher luminescence efficiency. More specifically, if the phosphorescence life is long, there arises such a problem that molecules placed in their triplet excited state which is a waiting state for phosphorescence are increased to lower the resultant luminescence efficiency particularly at a higher current density. The material according to the present invention is a suitable luminescent material for an EL device with a higher phosphorescence yield and a shorter phosphorescence life.

Incidentally, a phosphorescence yield (F(m)) is obtained based on the following equation:

$F(m)/F(s) = (S(m)/S(s)) \times (A(s)/A(m))$, wherein F represents a phosphorescence yield, S represents an integrated intensity of (photo-)excited emission spectrum, A represents an absorption spectrum of an excited light wavelength, and m represents an unknown material.

[0036]

In a conventional phosphorescent device, the

platinum-porphiline complex is used as the luminescent material, but the luminescent material according to the present invention has a carbon-platinum bond, thus particularly effectively exhibiting a heavy atom effect of platinum (Pt) compared to the case of N-Pt bond. As a result, a spin-orbit interaction is enhanced to realize a higher phosphorescence yield and a shorter phosphorescence life at the same time. Further, molecules of the metal coordination compound have a shorter time period wherein they stay in the triplet excited state, thus prolonging the life of the device with less deterioration. In this regard, the (metal coordination) compound according to the present invention has been clarified to exhibit excellent performance even in terms of stability as shown in Examples described hereinafter.

[0037]

In the case of phosphorescent (luminescent) material, luminescent characteristics are largely affected by its molecular environment. Principal characteristics of the fluorescent material are studied based on photoluminescence in the case of fluorescence device. However, results of photoluminescence (of the phosphorescent material) do not reflect luminescent characteristics of the resultant EL device in many cases since the luminescent characteristics in the case of the

phosphorescence depend on a magnitude of polarity of ambient host material molecules, ambient temperature, whether presence state of the material is solid state or liquid state, etc. Accordingly, it is generally difficult to expect the resultant EL characteristics (for the phosphorescent material) by simply removing a part of characteristics from photoluminescence results.

[0038]

As a feature of molecular structure, the platinum complex has a planar structure. Energy transfer of triplet exciton (i.e., energy transfer from host material molecule in the triplet excited state to guest material molecule) is performed based on electron exchange between adjacent molecules (so-called Dexter transfer). In this transfer, a degree of overlapping of electron cloud between adjacent molecules is an important factor, so that the planar molecular structure is suitable for efficient energy transfer. In the conventional devices, $Ir(ppy)_3$ (indium-phenylpyrimidine complex) represented by the above-described formula has a steric octahedral coordination structure with six ligands, so that it is considered that energy transfer in Dexter transfer from host material molecule is not performed efficiently.

[0039]

From the viewpoints as described above, the platinum complex according to the present invention is a suitable luminescent material for EL device.

[0040]

The luminescence device according to the present invention, as shown in Figure 1, may preferably be an electroluminescence device wherein the organic layer comprising the metal coordination compound is sandwiched between two oppositely disposed electrodes, and a voltage is applied between the electrodes to produce luminescence.

[0041]

The high-efficiency luminescence device according to the present invention may be applicable to devices required to allow energy saving and high luminance. Applied examples thereof may include those for display apparatus and illumination apparatus, a light source for printers, and backlight (unit) for a liquid crystal display apparatus. As the display apparatus, it is possible to provide a flat panel display apparatus capable of exhibiting an excellent energy saving performance, a high visibility and a good lightweight property. With respect to the light source, it becomes possible to replace a laser light source of laser beam printer currently used widely with the luminescence device according to the present invention. Further, when the luminescence device of

the present invention is arranged in independently addressable arrays as an exposure means for effecting desired exposure of light to a photosensitive drum for forming an image, it becomes possible to considerably reducing the volume (size) of image forming apparatus. With respect to the illumination apparatus and backlight (unit), the resultant apparatus (unit) using the luminescence device of the present invention can be expected to have an energy saving effect.

[0042]

Hereinbelow, specific structures of the metal coordination compound used in the present invention are shown in Tables 1 - 7. However, these structures merely show representative examples, and the present invention is not limited to these examples. Pr to Pz' used in Tables 1 - 7 represent structures shown in Chem. Formulas 9 - 11.

[0043]

Incidentally, in Chem. Formula 9, an uncombined linkage oriented in a lower-right direction shows a linkage with platinum atom, and an uncombined linkage oriented in a rightward direction shows a linkage with a cyclic group.

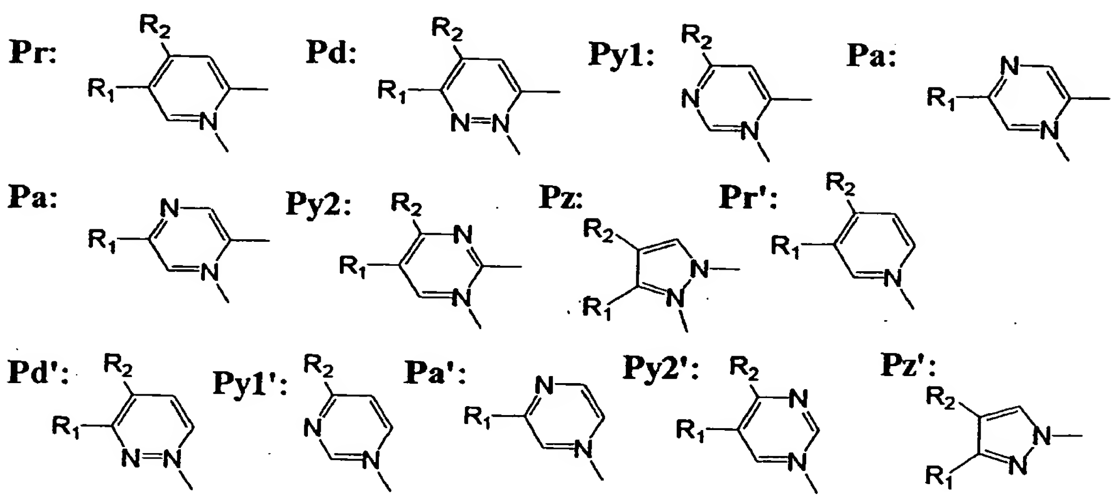
[0044]

Incidentally, in Chem. Formulas 10 and 11, an uncombined linkage oriented in a upper-right direction shows a linkage with platinum atom, and an uncombined

linkage oriented in a upward direction shows a linkage with a cyclic group.

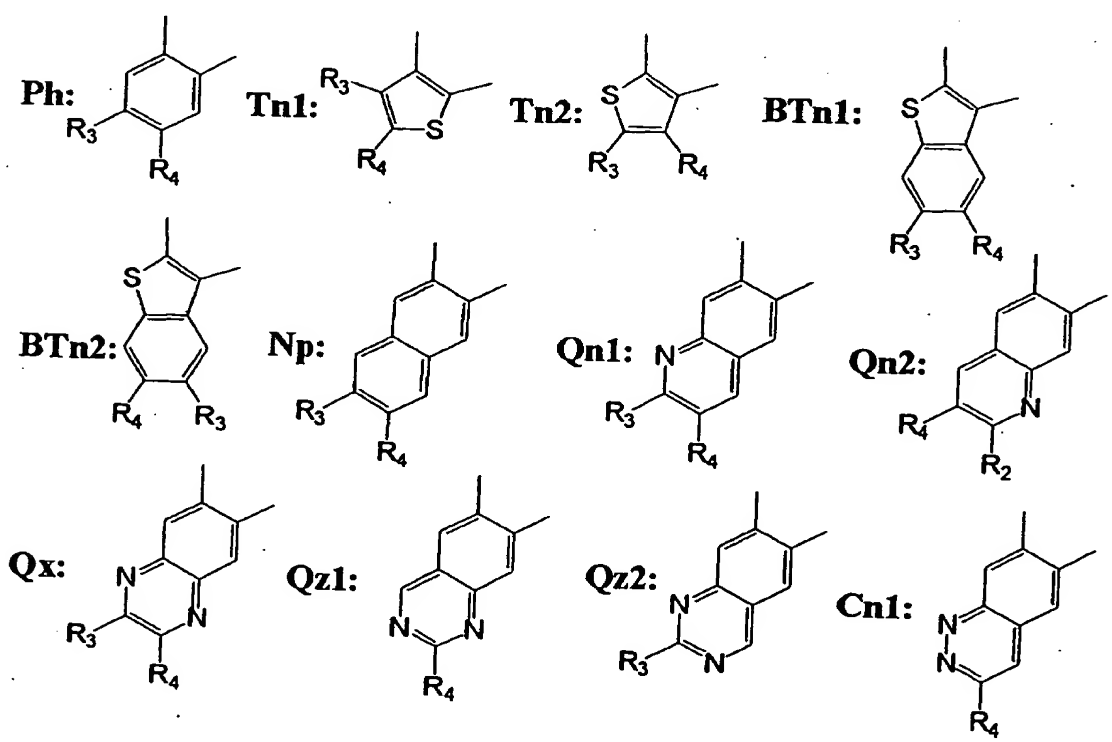
[0045]

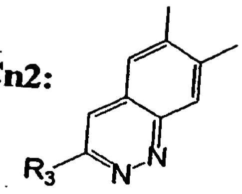
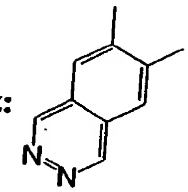
[Chem. Formula 9]



[0046]

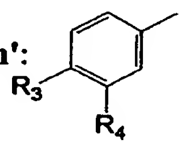
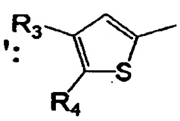
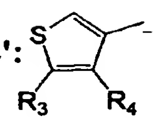
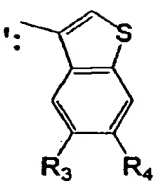
[Chem. Formula 10]

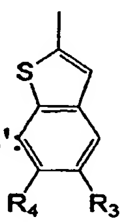
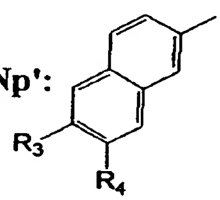
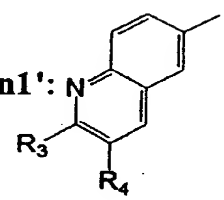
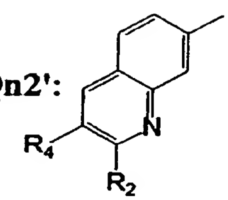


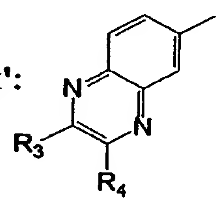
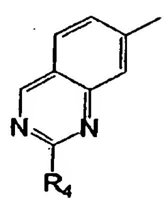
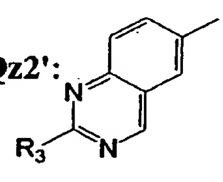
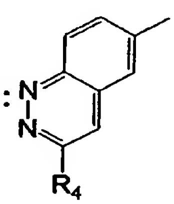
Cn2:  Pz: 

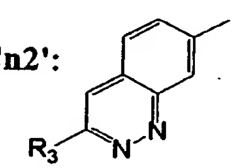
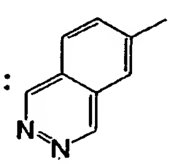
[0047]

[Chem. Formula 11]

Ph':  Tn1':  Tn2':  BTn1': 

BTn2':  Np':  Qn1':  Qn2': 

Qx':  Qz1':  Qz2':  Cn1': 

Cn2':  Pz': 

[0048]

[Table 1]

No	Formula	A N	N A'	B C	C B'	R_1	R_2	R_3	R_4
101	(1-1)	Pr	Pr	Ph	Ph	H	H	H	H
102	(1-1)	Pr	Pr	Tn1	Tn1	H	H	H	H
103	(1-1)	Pr	Pr	Tn2	Tn2	H	H	H	H
104	(1-1)	Pr	Pr	Tn3	Tn3	H	H	H	H
105	(1-1)	Pr	Pr	BTn1	BTn1	H	H	H	H
106	(1-1)	Pr	Pr	BTn2	BTn2	H	H	H	H
107	(1-1)	Pr	Pr	Np	Np	H	H	H	H
108	(1-1)	Pr	Pr	Qn1	Qn1	H	H	H	H
109	(1-1)	Pr	Pr	Qn2	Qn2	H	H	H	H
110	(1-1)	Pa	Pa	Ph	Ph	H	H	H	H
111	(1-1)	Pa	Pa	Tn1	Tn1	H	H	H	H
112	(1-1)	Pa	Pa	Tn2	Tn2	H	H	H	H
113	(1-1)	Pa	Pa	Tn3	Tn3	H	H	H	H
114	(1-1)	Pa	Pa	BTn1	BTn1	H	H	H	H
115	(1-1)	Pa	Pa	BTn2	BTn2	H	H	H	H
116	(1-1)	Pa	Pa	Np	Np	H	H	H	H
117	(1-1)	Pa	Pa	Qn1	Qn1	H	H	H	H
118	(1-1)	Pa	Pa	Qn2	Qn2	H	H	H	H
119	(1-1)	Pz	Pz	Ph	Ph	H	H	H	H
120	(1-1)	Pz	Pz	Tn1	Tn1	H	H	H	H
121	(1-1)	Pz	Pz	Tn2	Tn2	H	H	H	H
122	(1-1)	Pz	Pz	Tn3	Tn3	H	H	H	H
123	(1-1)	Pz	Pz	BTn1	BTn1	H	H	H	H
124	(1-1)	Pz	Pz	BTn2	BTn2	H	H	H	H
125	(1-1)	Pz	Pz	Np	Np	H	H	H	H

[0049]

[Table 2]

No	Formula	A N	N A'	B C	C B'	R_1	R_2	R_3	R_4
126	(1-1)	Pz	Pz	Qn1	Qn1	H	H	H	H
127	(1-1)	Pz	Pz	Qn2	Qn2	H	H	H	H
128	(1-2)	Pr	Pr	Ph	Ph	H	H	H	H
129	(1-2)	Pr	Pr	Tn1	Tn1	H	H	H	H
130	(1-2)	Pr	Pr	Tn2	Tn2	H	H	H	H
131	(1-2)	Pr	Pr	BTn1	BTn1	H	H	H	H
132	(1-2)	Pr	Pr	BTn2	BTn2	H	H	H	H
133	(1-2)	Pr	Pr	Np	Np	H	H	H	H
134	(1-2)	Pr	Pr	Qn1	Qn1	H	H	H	H
135	(1-2)	Pr	Pr	Qn2	Qn2	H	H	H	H
136	(1-2)	Pr	Pr	Qx	Qx	H	H	H	H
137	(1-2)	Pr	Pr	Qz1	Qz1	H	H	H	H
138	(1-2)	Pr	Pr	Qz2	Qz2	H	H	H	H
139	(1-2)	Pr	Pr	Cn1	Cn1	H	H	H	H
140	(1-2)	Pr	Pr	Cn2	Cn2	H	H	H	H
141	(1-2)	Pr	Pr	Pz	Pz	H	H	H	H
142	(1-2)	Pd	Pd	Ph	Ph	H	H	H	H
143	(1-2)	Pd	Pd	Tn1	Tn1	H	H	H	H
144	(1-2)	Pd	Pd	Tn2	Tn2	H	H	H	H
145	(1-2)	Pd	Pd	BTn1	BTn1	H	H	H	H
146	(1-2)	Pd	Pd	BTn2	BTn2	H	H	H	H
147	(1-2)	Pd	Pd	Np	Np	H	H	H	H
148	(1-2)	Pd	Pd	Qn1	Qn1	H	H	H	H
149	(1-2)	Pd	Pd	Qn2	Qn2	H	H	H	H
150	(1-2)	Pd	Pd	Qx	Qx	H	H	H	H

[0050]

[Table 3]

No	Formula	A N	N A'	B C	C B'	R_1	R_2	R_3	R_4
151	(1-2)	Pd	Pd	Qz1	Qz1	H	H	H	H
152	(1-2)	Pd	Pd	Qz2	Qz2	H	H	H	H
153	(1-2)	Pd	Pd	Cn1	Cn1	H	H	H	H
154	(1-2)	Pd	Pd	Cn2	Cn2	H	H	H	H
155	(1-2)	Pd	Pd	Pz	Pz	H	H	H	H
156	(1-2)	Py1	Py1	Ph	Ph	H	H	H	H
157	(1-2)	Py1	Py1	Tn1	Tn1	H	H	H	H
158	(1-2)	Py1	Py1	Tn2	Tn2	H	H	H	H
159	(1-2)	Py1	Py1	BTn1	BTn1	H	H	H	H
160	(1-2)	Py1	Py1	BTn2	BTn2	H	H	H	H
161	(1-2)	Py1	Py1	Np	Np	H	H	H	H
162	(1-2)	Py1	Py1	Qn1	Qn1	H	H	H	H
163	(1-2)	Py1	Py1	Qn2	Qn2	H	H	H	H
164	(1-2)	Py1	Py1	Qx	Qx	H	H	H	H
165	(1-2)	Py1	Py1	Qz1	Qz1	H	H	H	H
166	(1-2)	Py1	Py1	Qz2	Qz2	H	H	H	H
167	(1-2)	Py1	Py1	Cn1	Cn1	H	H	H	H
168	(1-2)	Py1	Py1	Cn2	Cn2	H	H	H	H
169	(1-2)	Py1	Py1	Pz	Pz	H	H	H	H
170	(1-2)	Pa	Pa	Ph	Ph	H	H	H	H
171	(1-2)	Pa	Pa	Tn1	Tn1	H	H	H	H
172	(1-2)	Pa	Pa	Tn2	Tn2	H	H	H	H
173	(1-2)	Pa	Pa	BTn1	BTn1	H	H	H	H
174	(1-2)	Pa	Pa	BTn2	BTn2	H	H	H	H
175	(1-2)	Pa	Pa	Np	Np	H	H	H	H

[0051]

[Table 4]

No	For-mula	A N	N A'	B C	C B'	R_1	R_2	R_3	R_4
176	(1-2)	Pa	Pa	Qn1	Qn1	H	H	H	H
177	(1-2)	Pa	Pa	Qn2	Qn2	H	H	H	H
178	(1-2)	Pa	Pa	Qx	Qx	H	H	H	H
179	(1-2)	Pa	Pa	Qz1	Qz1	H	H	H	H
180	(1-2)	Pa	Pa	Qz2	Qz2	H	H	H	H
181	(1-2)	Pa	Pa	Cn1	Cn1	H	H	H	H
182	(1-2)	Pa	Pa	Cn2	Cn2	H	H	H	H
183	(1-2)	Pa	Pa	Pz	Pz	H	H	H	H
184	(1-2)	Py2	Py2	Ph	Ph	H	H	H	H
185	(1-2)	Py2	Py2	Tn1	Tn1	H	H	H	H
186	(1-2)	Py2	Py2	Tn2	Tn2	H	H	H	H
187	(1-2)	Py2	Py2	BTn1	BTn1	H	H	H	H
188	(1-2)	Py2	Py2	BTn2	BTn2	H	H	H	H
189	(1-2)	Py2	Py2	Np	Np	H	H	H	H
190	(1-2)	Py2	Py2	Qn1	Qn1	H	H	H	H
191	(1-2)	Py2	Py2	Qn2	Qn2	H	H	H	H
192	(1-2)	Py2	Py2	Qx	Qx	H	H	H	H
193	(1-2)	Py2	Py2	Qz1	Qz1	H	H	H	H
194	(1-2)	Py2	Py2	Qz2	Qz2	H	H	H	H
195	(1-2)	Py2	Py2	Cn1	Cn1	H	H	H	H
196	(1-2)	Py2	Py2	Cn2	Cn2	H	H	H	H
197	(1-2)	Py2	Py2	Pz	Pz	H	H	H	H
198	(1-2)	Pz	Pz	Ph	Ph	H	H	H	H
199	(1-2)	Pz	Pz	Tn1	Tn1	H	H	H	H
200	(1-2)	Pz	Pz	Tn2	Tn2	H	H	H	H

[0053]

[Table 5]

No	For-mula	A N	N A'	B C	C B'	R_1	R_2	R_3	R_4
201	(1-2)	Pz	Pz	BTn1	BTn1	H	H	H	H
202	(1-2)	Pz	Pz	BTn2	BTn2	H	H	H	H
203	(1-2)	Pz	Pz	Np	Np	H	H	H	H
204	(1-2)	Pz	Pz	Qn1	Qn1	H	H	H	H
205	(1-2)	Pz	Pz	Qn2	Qn2	H	H	H	H
206	(1-2)	Pz	Pz	Qx	Qx	H	H	H	H
207	(1-2)	Pz	Pz	Qz1	Qz1	H	H	H	H
208	(1-2)	Pz	Pz	Qz2	Qz2	H	H	H	H
209	(1-2)	Pz	Pz	Cn1	Cn1	H	H	H	H
210	(1-2)	Pz	Pz	Cn2	Cn2	H	H	H	H
211	(1-2)	Pz	Pz	Pz	Pz	H	H	H	H
212	(1-3)	Pr'	Pr'	Ph	Ph	H	H	H	H
213	(1-3)	Pd'	Pd'	Ph	Ph	H	H	H	H
214	(1-3)	Py1'	Py1'	Ph	Ph	H	H	H	H
215	(1-3)	Pa'	Pa'	Tn1	Tn1	H	H	H	H
216	(1-3)	Py2'	Py2'	Tn2	Tn2	H	H	H	H
217	(1-3)	Pz2'	Pz2'	BTn1	BTn1	H	H	H	H
218	(1-4)	Pr	Pr	Ph'	Ph'	H	H	H	H
219	(1-4)	Pd	Pd	Ph'	Ph'	H	H	H	H
220	(1-4)	Py1	Py1	Tn1'	Tn1'	H	H	H	H
221	(1-4)	Pa	Pa	Tn1'	Tn1'	H	H	H	H
222	(1-4)	Py2	Py2	Qx'	Qx'	H	H	H	H
223	(1-4)	Pz2	Pz2	Qz1'	Qz1'	H	H	H	H
224	(1-5)	Pr	Pr'	Ph	Ph'	H	H	H	H
225	(1-5)	Pd	Pr'	Ph	Ph'	H	H	H	H

[0053]

[Table 6]

No	Formula	A N	N A'	B C	C B'	R_1	R_2	R_3	R_4
226	(1-5)	Pr	Pr'	Tn1	Ph'	H	H	H	H
227	(1-5)	Pa	Pr'	Ph	Ph'	H	H	H	H
228	(1-5)	Pz	Pr'	Tn1	Ph'	H	H	H	H
229	(1-5)	Pz	Pr'	Tn2	Ph'	H	H	H	H
230	(1-6)	Pr'	Pr'	Ph'	Ph'	H	H	H	H
231	(1-6)	Pa'	Pa'	Ph'	Ph'	H	H	H	H
232	(1-6)	Pz'	Pz'	Ph'	Ph'	H	H	H	H
233	(1-2)	Pr	Pr	Ph	Ph	H	OCH_3	H	H
234	(1-2)	Pr	Pr	Ph	Ph	CF_3	H	H	H
235	(1-2)	Pr	Pr	Ph	Ph	H	OCF_3	H	H
236	(1-2)	Pr	Pr	Ph	Ph	H	F	H	H
237	(1-2)	Pr	Pr	Ph	Ph	F	H	H	H
238	(1-2)	Pr	Pr	Ph	Ph	H	C_2H_5	H	H
239	(1-2)	Pr	Pr	Ph	Ph	C_2H_5	H	H	H
240	(1-2)	Pr	Pr	Ph	Ph	H	H	H	CH_3
241	(1-2)	Pr	Pr	Ph	Ph	H	H	H	C_3H_7
242	(1-2)	Pr	Pr	Ph	Ph	H	H	H	OCH_3
243	(1-2)	Pr	Pr	Ph	Ph	H	H	H	F
244	(1-2)	Pr	Pr	Ph	Ph	H	H	H	NO_2
245	(1-2)	Pr	Pr	Ph	Ph	H	H	NO_2	H
246	(1-2)	Pr	Pr	Ph	Ph	H	H	H	$CH_2CH\equiv CHCH_2CH_3$
247	(1-2)	Pr	Pr	Ph	Ph	H	H	H	$CH_2C=CCH_2CH_3$
248	(1-2)	Pr	Pr	Ph	Ph	H	H	H	CF_3
249	(1-2)	Pr	Pr	Ph	Ph	H	H	H	$COOC_2H_5$
250	(1-2)	Pr	Pr	Ph	Ph	H	H	H	$OCOC_3H_7$

[0054]

[Table 7]

No	Formula	A N	A' N	B C	B' C	R_1	R_2	R_3	R_4
251	(1-2)	Pr	Pr	Ph	Ph	H	H	CH_3	H
252	(1-2)	Pr	Pr	Ph	Ph	H	H	F	H
253	(1-2)	Pr	Pr	Ph	Ph	H	H	OCH_3	H
254	(1-2)	Pr	Pr	Ph	Ph	H	H	H	SCH_3
255	(1-2)	Pr	Pr	Tn1	Tn1	H	H	H	$Si(CH_3)_3$
256	(1-2)	Pr	Pr	Tn1	Tn1	H	H	H	CH_3
257	(1-2)	Pr	Pr	Tn1	Tn1	H	H	H	OCH_3
258	(1-2)	Pr	Pr	Tn1	Tn1	H	H	H	F
259	(1-2)	Pr	Pr	Tn1	Tn1	H	H	H	CF_3
260	(1-2)	Pr	Pr	Tn1	Tn1	H	H	H	C_3H_7
261	(1-2)	Pr	Pr	Tn1	Tn1	F	H	H	H
262	(1-2)	Pr	Pr	Tn1	Tn1	H	CH_3	H	H
263	(1-2)	Pr	Pr	Tn1	Tn1	H	OCH_3	H	H
264	(1-2)	Pr	Pr	Tn1	Tn1	H	CF_3	H	H
265	(1-4)	Pr	Pr	Ph'	Ph'	H	H	OCH_3	OCH_3
266	(1-6)	Pr'	Pr'	Ph'	Ph'	H	H	OCH_3	H
267	(1-6)	Pa'	Pa'	Ph'	Ph'	H	H	OCH_3	H

[0055]

[Examples]

A common portion of device preparation steps used in the present invention will be described.

[0056]

As a device structure, a device having a three-layer structure of organic layers shown in (b) of Figure 1 was used. On a glass substrate (transparent substrate 15), a 100 nm-thick film (transparent electrode 14) of ITO (indium tin oxide) was formed by sputtering, followed by patterning to have an (opposing) electrode area of 3 mm^2. On the ITO-formed substrate, organic layers and metal electrode layers shown below were successively formed in film by vacuum (vapor) deposition using resistance heating in a vacuum chamber (10^{-4} Pa).

Organic layer 1 (hole transport layer 18) (40 nm): α-NPD

Organic layer 2 (luminescence layer 12) (30 nm): mixture of CBP:Pt complex (Pt complex weight proportion: 5 wt. %)

Organic layer 3 (electron transport layer 16) (30 nm): Alq3

Metal electrode layer 1 (15 nm): Al-Li alloy (Li = 1.8 wt. %)

Metal electrode layer 2 (100 nm): Al

[0057]

An electric field was applied between the ITO electrode (as an anode) and the Al electrode (as a cathode) to apply a voltage to each device so as to provide the device with the same current value, thus measuring a luminance (brightness) with time. The constant current amount was 70 mA/cm^2. At that time, the resultant luminances of the respective devices were in the range of 80 - 120 cd/m^2.

[0058]

As the cause of device deterioration, oxygen or moisture (water content) is a problematic factor, so that each device was subjected to the above measurement in a dry nitrogen gas stream after it was taken out of the vacuum chamber so as to remove such a factor.

[0059]

Examples 1 - 11 and Comparative Example 1

The results of energization durability test of the devices using the respective compounds are shown in Table 8. The devices using Compounds 1 - 11 provide luminance half-life times clearly longer than the device using the conventional luminescent material, so that it becomes possible to realize a high-durability device resulting from stability of the materials of the present invention. Incidentally, the luminescence devices using the metal coordination compounds 3, 5, 6, 7 and 11 produced red luminescence,

and the luminescence devices using the metal coordination compounds 2 and 4 produced orange luminescence. Further, the luminescence devices using the metal coordination compound 1 produced green luminescence.

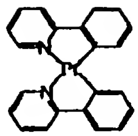
[0060]

Table 8

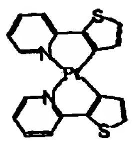
Ex.No. or Comp.Ex. No	Luminescent material	Luminance half-life (Hr)
Ex. 1	Compound 1	500
Ex. 2	" 2	400
Ex. 3	" 3	600
Ex. 4	" 4	650
Ex. 5	" 5	950
Ex. 6	" 6	800
Ex. 7	" 7	850
Ex. 8	" 8	600
Ex. 9	" 9	450
Ex. 10	" 10	900
Ex. 11	" 11	550
Comp.Ex. 1	$Ir(ppy)_3$	350

[0061]

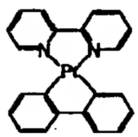
Compound 1



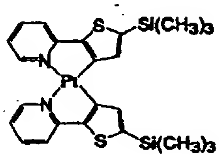
Compound 2



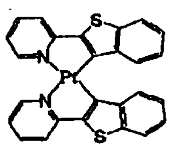
Compound 3



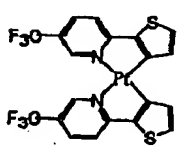
Compound 4



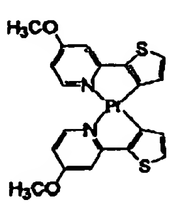
Compound 5



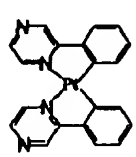
Compound 6



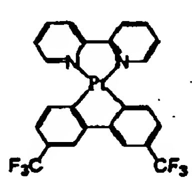
Compound 7



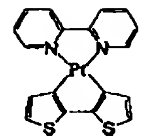
Compound 8



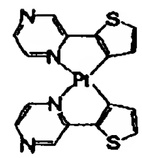
Compound 9



Compound 10



Compound 11



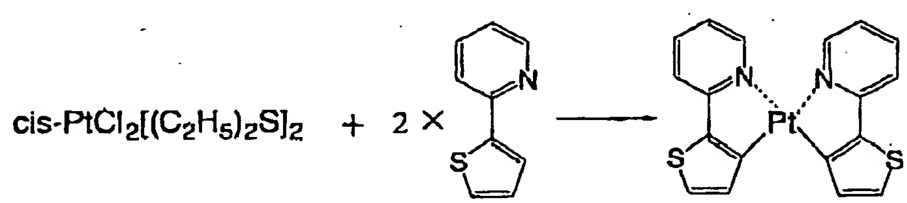
[0062]

Hereinbelow, synthesis processes of the above-mentioned compounds 2, 3 and 5 will be shown. Incidentally, the compounds 9 and 10 can be synthesized through the similar synthesis process as the compound 3. The compounds 1, 4, 6, 7 and 8 can be synthesized through the same synthesis process as the compound 2.

[0063]

Example 12 (Synthesis of Compound 2)

[0064]



[0065]

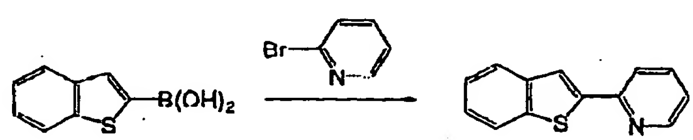
In a 3 liter-three necked flask, 14.6 g (90.6 mM) of 2-(2-thienyl)pyridine and 912 ml of anhydrous ether were placed and stirred at -70 °C or below in an argon gas stream. To the mixture, 62.2 ml (99.5 mM) of 1.6M-t-butyllithium solution in pentane was added dropwise in ca. 35 min., followed by stirring at -70 °C for 40 min. At that temperature, a suspension of 8.5 g (19.0 mM) of cis-$PtCl_2[(C_2H_5)_2S]_2$ in a mixture solvent of 289 ml of anhydrous ether and 73 ml of anhydrous tetrahydrofuran (THF) was added dropwise in

ca. 1 hour to the resultant mixture, followed by stirring at -70 °C for 30 min. and gradual temperature rise up to 0 °C in ca. 2 hours. To the reaction mixture, 912 ml of water was gradually added dropwise at 0 °C. The organic layer was washed with common salt aqueous solution and the aqueous (water) layer was subjected to extraction with methylene chloride. The resultant organic layer (from the organic and aqueous layers) was dried with anhydrous sodium sulfate, followed by distilling-off of the solvent to obtain a residue. The residue was recrystallized from a mixture solvent (hexane/methylene chloride) to obtain 4.50 g of cis-bis[2-(2-thienyl)pyridinato-N,$C^{5'}$] platinum (II) (Yield: 45.8 %).

[0066]

Example 13 (Synthesis of Compound 5)

[0067]



[0068]

In a 1 liter-three necked flask, 26.6 g (168.5 mM) of 2-bromopyridine, 30.0 g (168.5 mM) of benzo[b]thiophene-2-boronic acid, 170 ml of toluene, 85 ml of ethanol and 170 ml of 2M-sodium carbonate

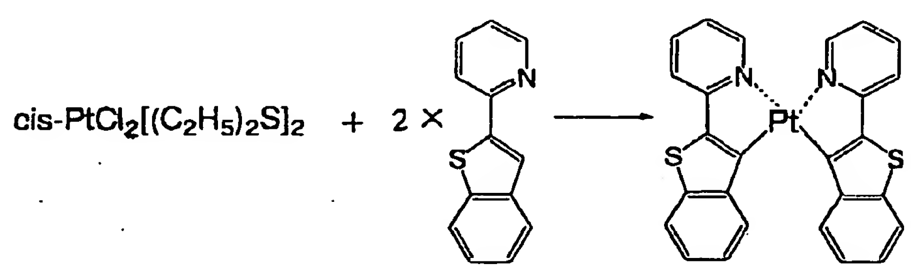
aqueous solution were placed and stirred in a nitrogen gas stream at room temperature. Under stirring, to the mixture, 6.18 g (5.35 mM) of tetrakis(triphenylphosphine) palladium (0) was added, followed by heat-refluxing for 5.5 hours under stirring in nitrogen gas stream.

After the reaction, the reaction mixture was cooled, followed by extraction with cool water and toluene. The organic layer was washed with water until the system showed neutral, followed by distilling off of the solvent under reduced pressure to obtain a residue. The residue was purified by silica gel column chromatography (eluent: toluene/hexane = 5/1) to obtain a colorless crystal. The crystal was purified by alumina column chromatography (eluent: toluene) and recrystallized from ethanol to obtain 12.6 g of 2-(pyridine-2-yl)benzo[b]thiophene (Yield: 35.4 %).

[0069]

A synthesis process for coordinating the above ligand with platinum is shown below.

[0070]



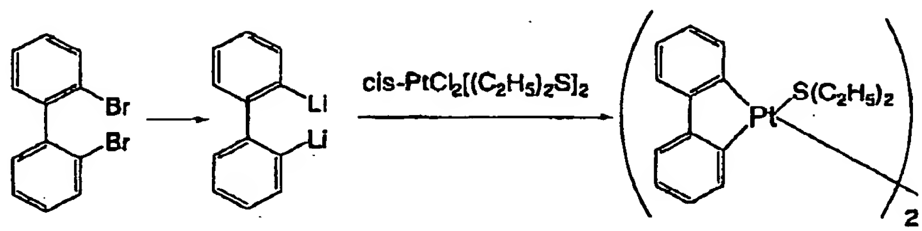
[0071]

In a 2 liter-three necked flask, 6.73 g (31.9 mM) of 2-(benzo[b]thiophene-2-yl)pyridine and 636 ml of anhydrous ether were placed and stirred at -70 ^{O}C or below in an argon gas stream. To the mixture, 21.9 ml (35.0 mM) of 1.6M-t-butyllithium solution in pentane was added dropwise in ca. 20 min., followed by stirring at -70 ^{O}C for 50 min. At that temperature, a suspension of 2.97 g (6.68 mM) of cis-$PtCl_2[(C_2H_5)_2S]_2$ in a mixture solvent of 101 ml of anhydrous ether and 25 ml of tetrahydrofuran (THF) was added dropwise in ca. 30 min. to the resultant mixture, followed by stirring at -70 ^{O}C for 1 hour. and gradual temperature rise up to 0 ^{O}C in ca. 2 hours. To the reaction mixture, 318 ml of water was gradually added dropwise at 0 ^{O}C. The organic layer was washed with common salt aqueous solution and the aqueous (water) layer was subjected to extraction with methylene chloride. The resultant organic layer (from the organic and aqueous layers) was dried with anhydrous sodium sulfate, followed by distilling-off of the solvent to obtain a residue. The residue was recrystallized from a mixture solvent (hexane/methylene chloride) to obtain 3.10 g of cis-bis[2-(benzo[b]thiophene-2-yl)pyridinato-N,$C^{5'}$] platinum (II) (Yield: 75.4 %).

[0072]

<u>Example 14</u> (Synthesis of Compound 3)

[0073]



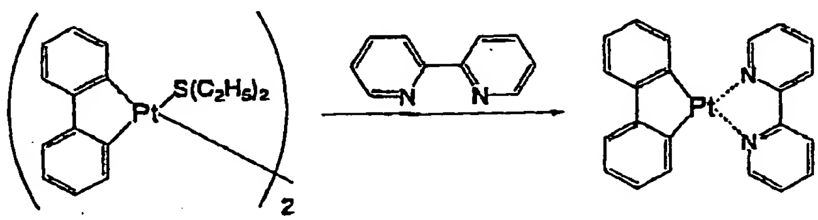
(a)

[0074]

In a 2 liter-three necked flask, 35.0 g (112 mM) of 2,2'-dibromobiphenyl and 650 ml of anhydrous ether were placed and stirred at -60 °C or below in an argon gas stream. To the mixture, 153 ml (0.245 mM) of 1.6M-n-butyllithium solution in pentane was added dropwise in ca. 50 min., followed by temperature rise and stirring at room temperature for 3 hours. To a suspension of 25.0 g (56.0 mM) of cis-$PtCl_2[(C_2H_5)_2S]_2$ in 833 ml of anhydrous ether cooled and kept at -10 °C or below, the resultant mixture was added dropwise in ca. 10 min., followed by stirring at -10 °C for 1 hour and gradual temperature rise up to 0 °C. To the reaction mixture, 417 ml of water was gradually added dropwise at 0 °C. The organic layer was washed with common salt aqueous solution and the aqueous (water) layer was subjected to extraction with methylene chloride. The resultant organic layer (from the organic and aqueous layers) was dried with anhydrous sodium sulfate, followed by distilling-off of the

solvent to obtain a residue. The residue was successively recrystallized from a mixture solvent (hexane/ether) and a mixture solvent (hexane/methylene chloride) to obtain 1.77 g of a compound (a) (Yield: 7.2 %).

[0075]



(a) (b)

[0076]

In a 100 ml-three-necked flask, 21.3 g (136 mM) of 2,2'-dipyridyl was placed and melted at 80 ^{O}C in an argon gas stream, followed by addition of 1.73 g (1.98 mM) of the above-prepared compound (a). The mixture was stirred at 80 ^{O}C for 10 min. under reduced pressure and cooled to ca. 10 ^{O}C to crystallize the mixture. The crystallized mixture was dissolved in methylene chloride and thereto, hexane was added to reprecipitate a crystal. The crystal was recovered by filtration, followed by recrystallization from a mixture solvent (hexane/methylene chloride) to obtain 1.90 g of an objective compound (b) (Yield: 95.4 %).

[0077]

[Effect of the Invention]

As described hereinabove, the metal coordination compound used in the present invention has a higher phosphorescence luminescence yield (efficiency) and a shorter phosphorescence life, thus being suitable as a luminescence material for an EL device.

[0078]

As a result, the luminescence device using the metal coordination compound according to the present invention is an excellent device which allows not only a high-efficiency luminescence but also maintains a high luminance for a long period of time and exhibits a less deterioration in energized state.

[Brief Description of the Drawing]

Figure 1 is a schematic (sectional) view illustrating a layer structure of the luminescence device of the present invention.

[Explanation of Symbols]

11: metal electrode

12: luminescence layer

13: hole-transporting layer

14: transparent electrode

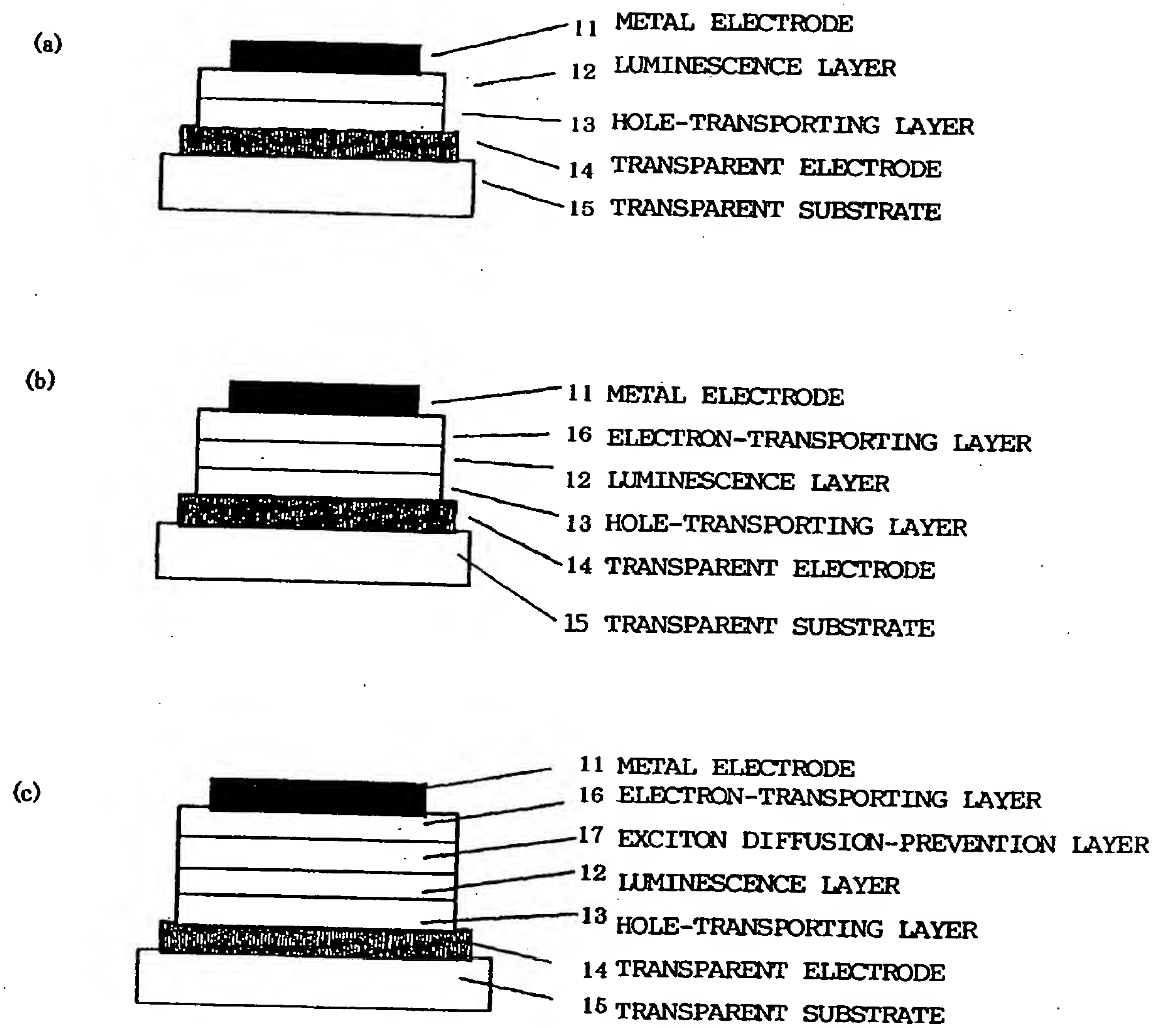
15: transparent substrate

16: electron-transporting layer

17: exciton diffusion-prevention layer

【DOCUMENT NAME】 DRAWING

FIG. 1



[Document Name]

Abstract

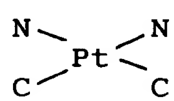
[Abstract]

[Problem]

To provide a luminescence device which produces high-efficiency luminescence, maintains a high brightness for a long period of time, and exhibits less deterioration in energized state.

[Solution Means]

A luminescence device including an organic compound layer which contains a metal coordination compound having a partial structure represented by the following formula (1):



(1).

[Selected Figure]

Figure 1